

Singapore: Selected Issues

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SINGAPORE

Selected Issues

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	Contents	Page
I.	Introduction.....	3
II.	Medium-Term Growth Prospects	5
	A. Introduction.....	5
	B. The Neoclassical Growth Theory and Growth Accounting.....	5
	C. Future Sources of Growth	9
	D. Estimating Medium-Term Growth Potential	10
	E. The Growth Slowdown of the Past Few Years	11
	F. Conclusion	12
	References.....	14
III.	The Role of the Corporate Sector in the Transmission of Shocks.....	15
	A. Introduction.....	15
	B. Corporate Vulnerability in Singapore	16
	C. The Corporate Sector's Role in Shock Transmission to Singapore.....	18
	D. Conclusion	19
	References.....	20
	Annex: The Data and Estimation.....	24
IV.	Development of the Corporate Bond Market.....	28
	A. Introduction.....	28
	B. Characteristics of Singapore's Financial Markets.....	28
	C. Conditions for Bond Market Development.....	29
	D. Regional Credit	31
	E. Activity in Singapore's Corporate Bond Market.....	33
	F. Singapore's Asset Management Industry	34
	G. Conclusion	36
	References.....	38

V.	Population Ageing and the Current Account Surplus.....	39
A.	Introduction.....	39
B.	Simulating Singapore's Current Account.....	40
C.	Conclusion.....	42
	References.....	43
	Annex: Model Description.....	44

Box

II.1	The TFP Debate.....	6
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Figures

II.1	Output Gap.....	12
III.1	Indicators of the Corporate Health in the Nonfinancial Corporate Sector, 2002.....	21
III.2	Indicators of Corporate Profitability for Nonfinancial Corporate Sector.....	22
III.3	The Role of the Corporate Sector in the Transmission of Shocks to Singapore, 1990–2002.....	23
IV.1	Equity Underwriting for Chinese Resident Businesses.....	32
V.1	The Actual Savings-Investment Balance in Singapore.....	39
V.2	Youth Dependency Ratios in Asia.....	40
V.3	Old-Age Dependency Ratios in Asia.....	40
V.4	The Simulated Ratio of the Child to Parent Cohort in Singapore.....	41
V.5	The Simulated Savings-Investment Balance in Singapore.....	41
V.6	Singapore: Current Account Balance Sensitivity Analysis.....	42

Tables

II.1	Singapore: Annual Growth.....	7
II.2	East Asia Less China: Annual Growth.....	8
II.3	United States: Annual Growth.....	8
II.4	Industrial Countries: Annual Growth.....	9
II.5	Average Years of Education of Population (15 years and older).....	9
II.6	Growth Projections: Varying TFP.....	10
II.7	Growth Projections: Varying Capital Growth Rates.....	11
II.8	Growth Projections: Varying the Capital Share.....	11
III.1	Data Description, December 2000.....	25
IV.1	Corporate Bonds Issued and Outstanding in Singapore.....	32
IV.2	International Bond Issuance Linked to Underwriters in Singapore and Hong Kong SAR.....	34
IV.3	Asset Management in Singapore.....	36

I. INTRODUCTION

1. **A series of events in recent years has underscored the vulnerability of Singapore's economy to external shocks.** Since the Asian financial crisis of 1997–98, the economy has been hit by the bursting of the tech bubble in 2000–01, and by the outbreak of SARS in early 2003, which exacerbated ongoing uncertainties associated with the Iraq war and the threat of international terrorism. As a result of these shocks, average economic growth slowed to about 2½ percent during 1998–2003, compared to over 9 percent in the decade prior to the Asian financial crisis, and unemployment rose to a 17-year high of 5.5 percent in September 2003. The economic shocks have come as Singapore is also facing structural challenges owing to competition from low-cost regional economies.
2. **While a strong recovery is now underway, challenges remain to enhance Singapore's medium-term competitiveness and growth prospects.** In response, the authorities have undertaken a wide range of reforms in recent years to liberalize and diversify the economy and promote flexibility. In particular, progress has been made in liberalizing the domestic banking, telecom, and utility sectors, reaching free trade agreements, reforming the tax system, and increasing wage and labor market flexibility. Such reforms have been given further impetus with the government's recent endorsement of the recommendations of the Economic Review Committee, which seek to enhance competitiveness and entrepreneurship.
3. **The following selected issues papers address themes associated with Singapore's vulnerability to economic shocks and the economy's medium-term prospects:**
 - **Medium-Term Growth Prospects** (Chapter II) assesses the economy's future growth potential. The chapter begins with a review of Singapore's historical growth experience using a growth accounting framework. The results indicate that a substantial part of Singapore's past growth can be explained by factor accumulation, rather than by productivity growth. These conclusions are used to gain insights into the economy's medium-term growth potential, which is projected to be in the range of 4–5 percent per year, somewhat below the high growth rates recorded in previous decades. The chapter emphasizes that growth prospects depend on structural reforms to enhance total factor productivity (TFP), and that there are potentially high returns to further investment in education.
 - **The Role of the Corporate Sector in the Transmission of Shocks** (Chapter III) assesses the health of the nonfinancial corporate sector and explores the sector's role in the transmission of external shocks to the economy. While the corporate sector is judged to be in good health, the chapter finds that profitability has been hit harder than in neighboring countries during the economic downturns of recent years. The chapter also finds that Singaporean firms are relatively more sensitive to external shocks than in other countries, due to the economy's small size and high degree of openness, as well as its concentration in industries that display a high sensitivity to shocks originating from abroad.

- **Development of the Corporate Bond Market** (Chapter IV) examines Singapore's efforts and prospects to maintain its role as a regional financial center through development of a corporate bond market, among other improvements. The authorities have taken measures to supply market infrastructure, and to diversify official investments in ways that may foster domestic markets. The paper finds that further development of the market may require tapping into regional financial flows to foster the underwriting of sufficient volumes of corporate debt in Singapore to support an active market.
- **Population Ageing and the Current Account Surplus** (Chapter V) assesses the role of demographics in explaining the evolution of the current account balance in Singapore. The chapter uses an optimizing model, in which changes in Singapore's age distribution drive the savings-investment balance. The model successfully replicates the historical shift in Singapore's current account from deficit to surplus in the early 1980s, and suggests that population ageing will tend to keep Singapore's current account in surplus over the medium term.

II. MEDIUM-TERM GROWTH PROSPECTS¹

A. Introduction

1. **Despite the downturn of recent years, Singapore's growth record over the past four decades has been impressive.** Per capita GDP growth from 1960–2003 averaged about 8 percent. In the past few years, however, growth has slowed down considerably. It was negative in 2001 and only slightly positive in 2002 and 2003. This chapter addresses the following questions: does this slowdown reflect a permanent decrease in the growth potential of the Singapore's economy, and what is the medium-term growth potential? In other words, how much of the growth slowdown is permanent, and how much is cyclical?

2. **Estimating a projected path for potential growth is sensitive to the theory of growth that is applied.** The standard view is the so-called “neo-classical” growth theory in which aggregate production is subject to decreasing returns on capital and labor. Assuming competitive factor markets, this implies that a country with a low capital stock relative to advanced economies will experience temporarily higher growth rates as physical and human capital levels catch up to those observed in advanced economies. As the economy matures, however, there are decreasing returns to scale, meaning that each additional unit of physical and human capital yields lower returns, and hence the growth rate of the economy converges to the growth rate of the advanced economies.

3. **This chapter reviews Singapore's past growth experience, and assesses its future growth potential by applying a neoclassical production function.** The chapter first uses the production function to analyze the sources of past growth in Singapore and compares it to the experience of other Asian and industrialized economies. The results indicate that a substantial part of Singapore's past growth can be explained by capital accumulation. These results are then used to gain insights into medium-term growth potential which is projected to be in the range of 4–5 percent per year. The chapter also discusses alternative estimates of the output gap, indicating that there is currently a considerable output gap in Singapore, on the order of 2.5–4.5 percent. This suggests that in the short run the economy may overshoot its medium-term growth potential as the economy recovers.

B. The Neoclassical Growth Theory and Growth Accounting

4. **This section reviews Singapore's growth experience and contrasts it to that of other Asian and industrialized countries.**² (See Box II.1, where the results are put in the context of a large and controversial literature on Singapore's growth.) It is assumed that production is characterized by a Cobb-Douglas production function:

¹ Prepared by Gauti Eggertsson (ext. 34918).

² This section is based on data collected by Bosworth and Collins (2003). For Singapore the data was extended to 2003.

BOX II.1. THE TFP DEBATE

The debate began with Young (1992) who argued, contrary to popular perception at the time, that economic growth in Singapore was driven by factor accumulation rather than by productivity growth. Of the average GDP growth rate of 8 percent, he estimated that growth in total factor productivity (TFP) accounts for less than 0.5 percentage points from the mid-1960s to 1990, with the remainder attributable to the accumulation of factor inputs. A study by Wong and Seng (1997) largely confirmed these results for 1975–1985 but showed a marked improvement in TFP growth in 1985–1995 (the latter half of that period is not covered in Young’s estimate). Young’s conclusions were widely discussed, for example by Krugman (1994), who interpreted them as indicating that Singapore could face a “Soviet-style” growth collapse.

TFP growth in Singapore has been broadly in line with that in advanced economies, and even slightly higher according to the estimate presented in this paper.

The difference in these results, relative to Young’s, is mainly due to the differing assumptions about the factor shares in the production function (1). The table shows how the results presented in this chapter would change if TFP were calculated by the average value of the factor shares assumed by Young. If Young’s factor shares are assumed, the results would be much closer to what he obtained. As has been emphasized by Gollin (2002), however, there are important measurement problems with factor shares. He finds that once these problems are addressed, factor shares are nearly constant across countries and time in the sample he studies. His result, therefore, provides some justification for the assumption maintained in this exercise. An estimate by Sarel (1997) gives further justification for the assumed value of the factor shares for Singapore.

TFP in Singapore (In percent)		
Period	$\alpha=0.35$	$\alpha=0.5$
1960–70	1.44	0.4
1970–80	0.91	-0.50
1980–90	1.58	0.8
1990–02	1.58	0.92
1960–02	1.36	0.22

Other recent work points to similar conclusions as those in this chapter, namely that TFP growth in Singapore has not been substantially lower than in other advanced and emerging economies.

Toh and Low (1996) identify possible imperfections in the labor market in Singapore, due to “latent factors.” If these factors are ignored they find that a researcher estimating factor shares from national accounts data would tend to overestimate the share of capital in the production function. In another study Wu and Thia (2003) estimates TFP but takes explicitly into account distortions caused by the housing market in Singapore. These adjustments have implications for factor shares, the estimate of output and the capital stock. The net effect of these adjustments has similar effect as assuming the low (relative to Young’s) constant factor shares assumed in this chapter. The reported TFP growth by Wu and Thia for 1990-2000 is 1.6 percent, which is the same as reported here. Hsieh (2002) calculates TFP in Singapore using a dual approach that builds on using factor prices to estimate the capital stock, rather than investment data from the national accounts. The result of that exercise is that TFP growth is dramatically higher than Young’s, and somewhat higher than in the results reported here. In sum, the results reviewed suggest that TFP growth in Singapore has not been as dramatically different from the industrial economies as was first suggested by Young (1992).

$$Y_t = A_t K_t^\alpha (H_t L_t)^{1-\alpha} \quad (1)$$

where K is physical capital, H is human capital, L is the labor force and A is total factor productivity (TFP). Human capital is measured by the function $H_t=(1.07)^s$ where s is years of schooling. This reflects the assumption that one year of additional schooling of the labor force increases aggregate production by 7 percent.³ The parameter α , where $0<\alpha<1$, is the capital share and measures the relative importance of capital and labor in production. It is assumed to be 0.35.⁴ With production function (1) growth can be decomposed into four components due to increases in the labor force, the capital stock, human capital and TFP. Importantly, the production function implies decreasing return to scale for each factor.

5. **The decomposition reveals that Singapore’s growth since 1960 has been driven largely by capital accumulation (Table II.1).**⁵ The columns labeled “weighted” in the table shows the contribution of each factor to growth. In the period 1960–70, for example,

capital’s contribution to growth was 5.6 percent. It is noteworthy that the contribution of physical capital to growth has been decreasing over time. In the period 1960–1970, the table indicates that about 60 percent of annual growth was attributed to an increase in the capital stock, while in the period 1990–2003, about 40 percent of growth was accounted for by capital accumulation. The

	1960–70	1970–80	1980–90	1990–03	1960–03
Output	9.4	8.6	7.2	6.2	7.7
Weighted labor	1.9	2.8	2.2	1.2	2.0
Raw labor	2.9	4.3	3.4	1.8	3.0
Weighted capital	5.6	4.8	3.2	2.6	4.0
Raw capital	15.9	13.8	9.0	7.5	11.3
Weighted education	0.5	0.1	0.3	0.8	0.5
Raw education	0.8	0.1	0.5	1.3	0.7
TFP	1.4	0.9	1.6	1.6	1.4

³ This is a fairly conservative estimate for the returns on education. A new study by the Monetary Authority of Singapore (MAS), for example, estimates that an additional year of education increases earning on average by 13.2 percent (see Low, Ouliaris, Robinson, and Mei (2004)).

⁴ The return on education and α are based on estimates by Bosworth and Collins (2003). The estimate of α is also consistent with Sarel’s (1997) estimate of factor shares in Singapore. Sensitivity of the results to varying the factor shares are discussed in Box II.1.

⁵ In this exercise the capital stock is estimated by investment data from the national accounts using the perpetual inventory model, the labor force is measured as total hours worked and the measure of human capital is obtained from Barro and Lee (2000). For 1960–2000 Bosworth and Collins (2003) estimate of the capital stock and the labor force is used, and the national account data are used to extent the series to 2003.

contribution of TFP has remained relatively stable, i.e., between 0.9–1.6 percent from 1960–2003. In total, over the past 43 years, capital accumulation has accounted for more than a half of the growth in Singapore and TFP less than one fifth.

6. Similar results hold for East Asia as a whole (excluding China).⁶ Roughly half of the GDP growth over the period 1960–2000 can be explained by an increase in the capital stock, and again, the contribution of capital to growth shows a downward trend. As in the case of Singapore, TFP accounts for less than one-fifth of growth. It is instructive to compare the growth experience of East Asia, and Singapore in particular, to the U.S. and the rest of the industrial countries. Table II.3 illustrates that in the U.S. physical capital accumulation has accounted for less than one-third of GDP growth, and that TFP has accounted for about one-fourth. Turning to the industrialized countries, the contribution of capital is about 40 percent (Table II.4).⁷ As would be expected from the neoclassical theory of growth, the contribution of the capital stock to growth is slightly higher than in the U.S., since this group includes countries that were relatively less economically advanced.

	1960–70	1970–80	1980–90	1990–2000	1960–2000
Output	6.4	7.6	7.2	5.7	6.7
Weighted labor	1.8	2.2	1.8	1.5	1.8
Raw labor	2.7	3.3	2.8	2.3	2.8
Weighted capital	2.7	3.9	3.4	3.2	3.3
Raw capital	7.7	11.2	9.8	9.0	9.4
Weighted education	0.4	0.6	0.6	0.5	0.5
Raw education	0.7	1.0	0.9	0.7	0.8
TFP	1.5	0.9	1.3	0.5	1.0

	1960–70	1970–80	1980–90	1990–2000	1960–2000
Output	3.8	3.2	3.2	3.3	3.4
Weighted labor	1.2	1.5	0.9	0.9	1.1
Raw labor	1.8	2.4	1.4	1.4	1.7
Weighted capital	0.7	0.9	1.0	1.2	1.0
Raw capital	1.9	2.7	2.9	3.6	2.8
Weighted education	0.4	0.7	0.1	0.1	0.3
Raw education	0.7	1.1	0.2	0.2	0.5
TFP	1.6	0.0	1.1	1.0	0.9

7. The pattern of capital accumulation and growth in Singapore is consistent with the prediction of the neoclassical growth model. In particular, the large increase in the

⁶ The countries in this sample are: Indonesia, Korea, Malaysia, the Philippines, Singapore, Taiwan Province of China, and Thailand. The data is obtained from Bosworth and Collins (2003) and each country is equally weighted. China is excluded due to data problems.

⁷ The countries in this sample are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and the United States. The data is obtained from Bosworth and Collins (2003) and each country is equally weighted.

capital/output ratio, from 0.8 in 1960 to 3.1 today, gives some evidence for decreasing returns to capital. This has important implications for predicting medium-term growth in Singapore. Decreasing returns to capital, coupled with the fact that Singapore’s capital/output ratio has reached those observed in advanced economies, provide some analytical support for the view that growth in coming years may be well below the average observed in the last 40 years, as our projection in Section D indicates. The contribution of capital to growth is likely to continue to decline. The contribution of labor is also likely to decline, as labor force participation rates have moved from relatively low levels in 1960 to levels comparable to those observed in industrialized economies today.

	1960–70	1970–80	1980–90	1990–2000	1960–2000
Output	5.2	3.3	2.9	2.5	3.5
Weighted labor	0.9	1.0	0.7	0.6	0.8
Raw labor	1.3	1.6	1.1	1.0	1.2
Weighted capital	1.8	1.5	1.1	1.1	1.4
Raw capital	5.1	4.3	3.1	3.1	3.9
Weighted education	0.3	0.5	0.2	0.2	0.3
Raw education	0.5	0.8	0.4	0.3	0.5
TFP	2.2	0.3	0.9	0.5	1.0

C. Future Sources of Growth

8. **This section provides some thoughts on how to boost medium-term growth prospects in Singapore.** In the context of the growth accounting framework outlined above, two sources of growth can be identified: further factor accumulation and faster TFP growth. Given the high labor force participation rates in Singapore and the relatively high capital/output ratio, the highest returns are likely to be derived from TFP growth and investment in education.

9. **Further investment in human capital may yield substantial gains.** Using average years of schooling as a measure of human capital (Barro and Lee, 2000), Singapore is seen to rank below the G7 countries (Table II.5). Based on the growth accounting exercise of the previous section, the return to education is high. For example, if educational achievement were to reach the same level as in the U.S. (12.12 years) Singapore’s GDP would increase by 17.5 percent according to the production function (1).

United States	12.12
Canada	12.02
Japan	10.78
Germany	11.04
France	8.86
Italy	8.27
United Kingdom	11.36
Singapore	8.15

10. **Other possible growth opportunities include policy measures to enhance efficiency.** One example is the Free Trade Agreements reached with the U.S., Japan, Australia, New Zealand, and others. These agreements are likely to have two impacts in the framework outlined above. Lower tariffs in trading partners increase the profitability of exporting companies for given inputs, leading to higher TFP. While free trade agreement could in principle have negative effects through trade diversion, this is unlikely to arise in Singapore’s case given almost no import tariffs. In addition, further

deregulation and structural reforms may also enhance efficiency by increasing the productivity of the existing capital stock and labor force. Measures to increase competition and enhance entrepreneurship would also work in this direction.

D. Estimating Medium-Term Growth Potential

11. **This section assesses Singapore’s medium-term growth potential.** The production function (1) and the associated growth accounting exercise outlined in Section B provide a useful framework to this end. Based on the assumption that the contribution of capital and labor continues to decline as Singapore moves into the league of highly-developed nations, the growth potential of the economy is estimated at 4–5 percent over the medium term.

12. **Three possible growth scenarios, ranging from 4.5 to 7.7 percent, can be considered based on differing TFP growth levels** (Table II.6). In these examples it is assumed that capital accumulation will continue to trend downward.⁸ Similarly, it is assumed that labor input contribution to growth will continue to decline based on demographic projections.⁹ Education levels are assumed to continue to rise.¹⁰ In the baseline scenario TFP growth is assumed to be equal to Singapore’s average level from 1960 to 2003. Case A

	Baseline	Case A	Case B
Output	4.5	4.1	7.7
Weighted labor	0.9	0.9	0.9
Raw labor	1.4	1.4	1.4
Weighted capital	1.4	1.4	1.4
Raw capital	4.0	4.0	4.0
Weighted education	0.8	0.8	0.8
Raw education	1.3	1.3	1.3
TFP	1.4	1.0	4.6

shows how this result would change if the contribution of TFP were equal to the level in the industrial countries in the period 1960–2000. Finally, case B shows the level of TFP growth that would be needed to support GDP growth at the 1960–2003 average level of 7.7 percent. This scenario is unlikely, as TFP growth would need to be 4.6 percent, an extremely high level by historical standards.

⁸ The assumption on the contribution to growth is obtained from a projection of the capital stock using a simple auto regression model with 3 lags. The number of lags was determined by estimating a model with an arbitrary large number of lags and then eliminating those (recursively) that were not statistically significant. The model was also estimated with a trend, but it was not statistically significant. This number reflects an average over 15 years horizon to reflect the “medium-term.” The model was estimated in logs.

⁹ Based on World Bank Population projections to 2020.

¹⁰ The assumed education’s contribution to growth is equal to its contribution during 1990–2000 but higher than in the period 1960–1990. This projection reflects that the data exhibits a structural break in 1990.

13. **The baseline projection is fairly robust to different assumptions about capital accumulation.** Table II.7 shows a sensitivity analysis of the baseline projection based on assuming different rates of investment. In case D the capital stock is projected by assuming that investment, as a fraction of GDP, stays constant at the average investment rate observed over the past 10 years. This results in higher capital accumulation than in the baseline scenario where the future capital stock was projected using a time series model. This scenario gives a reasonable upper bound on the growth projection for capital since a decline in investment is to be expected for an economy that is moving from the status of a developing economy to a highly developed one.

	Baseline	Case C	Case D
Output	4.5	4.2	4.8
Weighted labor	0.9	0.9	0.9
Raw labor	1.4	1.4	1.4
Weighted capital	1.4	1.1	1.7
Raw capital	4.0	3.1	4.8
Weighted education	0.8	0.8	0.8
Raw education	1.3	1.3	1.3
TFP	1.4	1.4	1.4

Case C shows how the result changes assuming the same rate of investment that was observed in 2003 (which is the lowest rate of investment as a fraction of GDP that has been observed in more than 30 years). This number is a bit below what is to be expected over the medium run, since some part of the decline in investment in 2003 relative to past years is likely to be due to cyclical factors.

14. **The baseline projection is relatively more dependent on differing assumptions of factor shares** (i.e., the value of α in the production function). Case E considers a case in which the value for the capital share is assumed to be 0.5 in line with Young's (1992) estimate (see Box II.1). This changes the projected TFP growth (which is assumed to be the same as the historical average of TFP growth in Singapore) and the contribution of each factor to growth. The net result is that the projected medium-term growth rate declines to 3.6 percent. Although this is a percentage point below the baseline projection it does not indicate the growth "collapse" that has sometimes been suggested (see discussion of Krugman (1994) in Box II.1).

	Baseline	Case E
Output	4.5	3.6
Weighted labor	0.9	0.7
Raw labor	1.4	1.4
Weighted capital	1.4	2.0
Raw capital	4.0	4.0
Weighted education	0.8	0.6
Raw education	1.3	1.3
TFP	1.4	0.2
Capital share	0.4	0.5

E. The Growth Slowdown of the Past Few Years

15. **This section assesses the extent to which the growth slowdown of the past few years in Singapore reflects cyclical versus structural factors.** Growth in Singapore was slightly negative in 2001 and it has only been modestly positive since. The result from the previous exercise indicates that potential growth is above the recent growth experience. In order to determine how much of the recent slowdown has been due to temporary shocks (e.g., to demand) and how much is due to reduction in long-term growth potential (e.g., due to the neoclassical convergence) the output gap is estimated. The output gap can be estimated using a wide range of approaches, from simple detrending techniques, to more structural

approaches, such as the production function approach. However, no single method is generally accepted. Two examples are given here, one based on the production function, and the other based on the Hodrick-Prescott (HP) filter.

16. **The production function approach (PF) is appealing for its close link to the growth exercises used in the previous sections.** Assuming the production function (1), potential output can be written as:

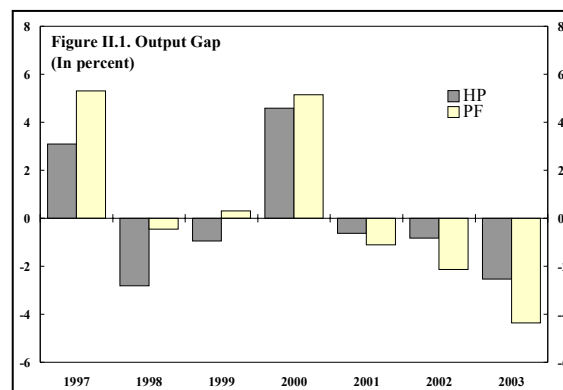
$$Y_t^* = A_t^* K_t^{*\alpha} (H_t^* L_t^*)^{1-\alpha} \quad (2)$$

where the asterisk denotes potential. It is assumed here that potential refers to the output that can be produced at full employment of the existing physical and human capital stock. Potential output can then deviate from actual output because labor is under utilized (due to temporary shocks) and/or because productivity is below potential (due to temporary shocks). To calculate the series for potential A_t^* and L_t^* the HP filter was applied to the series for L_t and the estimated series for A_t from Section B. This filter extracts short-term fluctuations from long-term trends in these two series. This interpretation of potential output is thus the output that would be produced absent short-term fluctuations in productivity and employment. Figure II.1 shows the output gap calculated by this method (PF), measured as the difference between actual and potential output. Another common estimate of the output gap is to approximate potential output by applying the HP filter directly to the output series.¹¹

17. **The estimated output gap for 2003 is in the range of 2.5–4.5 percent.** According to these estimates, a quite large part of the slowdown can be explained by short-term fluctuations, rather than movements in long-term trends. The negative output gap indicates that in the short run—as the output gap is closed—growth may be temporarily above the economy’s medium-term growth potential as the economy recovers.

F. Conclusion

18. **Singapore has recorded a remarkable record of economic development and growth over the last four decades.** In recent years, however, there has been an abrupt



¹¹ The largest part of the difference between the two estimates is that they are obtained by applying filters to quarterly versus annual data.

slowdown in the growth rate of the economy partly due to temporary shocks. More broadly, however, an overall slowdown in growth potential can be expected, compared to the high growth rates of the past few decades. A lower growth potential in the coming years is a reflection of Singapore's success in converging to per capita income levels of the world's wealthiest economies. The assessment given in this paper suggests that, looking forward, there are returns to be had from investment in education and from structural reforms to enhance TFP.

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III. THE ROLE OF THE CORPORATE SECTOR IN THE TRANSMISSION OF SHOCKS¹

A. Introduction

1. **Since the mid-1990s, Singapore has been hit by increasingly frequent economic shocks.** Following a modest downturn brought about by a rise in oil prices around the time of the Gulf War, the economy was buffeted by a global electronics downturn in 1996–1997, the Asian financial crisis in 1997–1998, and the collapse in U.S. demand for IT products in 2001 and subsequent slowdown across the major industrial economies. Most recently, the outbreak of Severe Acute Respiratory Syndrome (SARS) in early 2003 had a large negative impact on growth.
2. **Against this background, this chapter examines the health of Singapore’s corporate sector and its role in the transmission of shocks.** Regarding the former, it assesses the health of Singapore’s nonfinancial corporate sector through balance sheet and profitability analysis. In examining the role of the corporate sector in the transmission of shocks, it explores the extent to which Singapore’s industrial structure may be skewed toward sectors that are more sensitive to shocks from abroad or, more generally, whether Singapore’s companies may be more sensitive to foreign shocks than elsewhere, possibly due to the small and open nature of the economy.
3. **The results indicate that Singapore’s nonfinancial corporate sector is in generally good health.** Balance sheet indicators of leverage are among the lowest in the region and have been relatively stable over time. Various measures of liquidity have increased in recent years, from levels that were already high by international standards in the mid-1990s. While there is no evidence that the shocks of recent years have caused a deterioration in corporate balance sheets, profitability has been hit harder during the recent downturn than in other countries in the region.
4. **The analysis concludes that Singaporean firms have a higher sensitivity to external shocks than firms in other countries, consistent with the economy’s small size and high degree of openness.** There is also evidence that Singapore’s industrial composition is skewed toward sectors that display a high sensitivity to shocks from abroad, notably the IT hardware sector.
5. **This chapter is organized as follows:** Section B assesses leverage, liquidity, valuation and profitability of the nonfinancial corporate sector, section C examines the corporate sector’s role in the transmission of external shocks, and section D concludes; a description of the model and data is contained in the Annex.²

¹ Prepared by Robin Brooks (ext. 36236).

² For a detailed description of the data, see Brooks and Del Negro (2002). For an in-depth discussion of the factor model, see Brooks and Del Negro (2003).

B. Corporate Vulnerability in Singapore

6. **This section explores a range of balance sheet and profitability indicators that are commonly used as predictors of financial distress.**³ The literature on financial crises that originate in the corporate sector suggests that they typically unfold in two stages. The first stage consists of a long build-up of balance sheet fragilities rooted in poor governance, excessive credit expansion, accelerated capital inflows, and overheating of the economy. In the second stage, an external shock triggers a sudden crisis, whose severity depends on the degree of pre-crisis leverage, previous access to financing, and existing weaknesses in corporate governance and the general legal environment. Against this background, this section focuses on four indicators of corporate health: the debt-to-asset ratio as a measure of *leverage*, the cash-to-current liabilities ratio as a measure of *liquidity*, the price-to-earnings ratio as a measure of corporate *valuations*, and the return on assets as a measure of *profitability*.⁴ The data are from Worldscope, and are described in detail in the Annex.

7. **Any assessment of corporate vulnerability using balance sheet and profitability indicators is subject to data limitations.** To mitigate the absence of uniform accounting standards across countries, cross-country comparisons in the analysis are restricted to Asia, with the goal of keeping differences in accounting and legal practices to a minimum. To assess corporate vulnerability, this section proceeds in two ways: (i) it examines the time profile of the balance sheet and profitability indicators (a sharp rise in leverage relative to its historical norm could be indicative of emerging vulnerabilities); and (ii) it compares the balance sheet and profitability measures for Singapore's corporate sector to those for other countries in the region. This provides a useful perspective because many of the recent shocks have also adversely affected Singapore's neighbors. Differences across countries in the various indicators may thus be a measure of varying degrees of financial vulnerability.⁵

³ See Sundararajan and others (2002) for a survey of both the academic literature and work done at the IMF in this area. See Stone (2002a and 2002b) and Mulder and Perrelli (2002) for papers that use balance sheet variables as predictors of financial distress.

⁴ Various alternative measures also exist: the debt-to-equity ratio for *leverage*; the current ratio (current assets to current liabilities) and quick ratio (current assets less inventories relative to current liabilities) for *liquidity*; and return on equity for *profitability*. The key results in this section are unchanged using these alternative indicators and they are therefore omitted for brevity.

⁵ The data cover only listed firms. In Singapore, where a substantial share of the corporate sector is controlled by foreign multinationals (and thus not listed), this may be an important limitation. However, comparing performance and vulnerability indicators to a report by the Singapore Department of Statistics (2002), which contains indicators for Singapore's entire corporate sector (locally- and foreign-owned firms), shows that the data are representative.

8. **Leverage in Singapore's nonfinancial corporate sector is low.** Figure III.1 lists median debt-to-asset ratios of the nonfinancial corporate sector in 2002 for China, Hong Kong SAR, India, Korea, Malaysia, the Philippines, Taiwan Province of China, and Thailand. For comparison, it also gives this ratio for a group of countries called "Singapore's Competitors," consisting of Hong Kong SAR, Korea, Malaysia, Taiwan Province of China, Thailand, and the Philippines. These countries are competitors in the sense that they are all facing similar structural changes in response to the emergence of other countries in the region as low-cost electronics producers. The figure also provides the median debt-to-asset ratio across all 42 countries in the sample, a global benchmark against which to assess leverage in Singapore. The level of indebtedness in Singapore can be seen to be very low, both relative to other countries in the region and globally. It is also the case that leverage has been stable since the mid-1990s, unlike in other countries in the region, such as Korea or Thailand, where the corporate sector has been undergoing a fairly dramatic process of deleveraging in the wake of the Asian financial crisis.

9. **Meanwhile, standard measures of liquidity for Singapore's nonfinancial corporate sector are high.** Figure III.1 also lists median cash-to-current liabilities ratios for the same set of countries and aggregations in 2002. Liquidity in the Singapore's nonfinancial corporate sector is among the highest in the region and is also very high by global standards. Indeed, since the late-1990s, firms in Singapore have been raising liquidity levels, perhaps as precautionary step in reaction to many shocks in recent years.

10. **Valuations are reasonable, by regional standards and in historical perspective.** Figure III.1 shows median price-to-earnings ratios in 2002 for the same set of countries and the same regional and global aggregates. As can be seen, valuations in Singapore are consistent with those in the region. The median price-to-earnings ratio among Singapore's competitors amounts to 11.62, compared to 12.59 in Singapore. However, Singapore is far below global valuations, which have a median price-to-earnings ratio of 16.07. The median price-to-earnings ratio in Singapore has fallen quite sharply since the late-1990s, but this is in line with other markets in the region and the global correction in valuations.

11. **There are indications, however, that the global slowdown since 2000 hit the profitability of Singapore's corporate sector harder than elsewhere in the region.** Figure III.2 shows the median return on assets in 2002 for the same countries as before, for Singapore's competitors and for the global sample. In terms of profitability, Singapore's nonfinancial corporate sector is very close to the global average. Its return on assets is 3.96 percent, marginally above the global median of 3.75 percent. Singapore's corporate sector is far below other countries in the region in terms of profitability, however. The median return on assets in Singapore's competitors is 5.29 percent. Figure III.2 examines the evolution of the median return on assets in Singapore, both relative to its regional competitors and relative to global trends. It shows that the decline in Singapore's corporate profitability has been much sharper during the recent slowdown than in other countries in the region. The sharper decline could of course be cyclical, a reflection of Singapore's industrial composition, which is highly skewed toward industries that were directly exposed to the global slowdown in IT demand. But even within the IT sector there is evidence that

Singapore producers were hit harder by the recent downturn than elsewhere in the region, as can also be seen from Figure III.2. This could be a reflection of a higher cost base in Singapore, for example, or other factors above and beyond the global slowdown in IT demand.

C. The Corporate Sector's Role in Shock Transmission to Singapore

12. **This section explores the role of the corporate sector in the transmission of external shocks to Singapore.** It focuses on two alternative, though not mutually exclusive, hypotheses. First, it is possible that Singapore's corporate sector plays an important role in shock transmission because it is skewed toward sectors that display a high sensitivity to shocks from abroad. Second, given Singapore's status as a small, open economy, it is possible that companies are generally more sensitive to foreign shocks than elsewhere, regardless of what industry they belong to. These alternatives are evaluated using a factor model for international stock returns, as described in detail in the Annex. The model extracts the exposure of each individual stock in the sample to global, country- and industry-specific shocks. The global shock exposure measures the degree to which the return on an individual stock will be affected by global shocks, such as a downturn across the major industrial economies or an oil price shock. The exposure to country-specific shocks captures the degree to which the return on an individual stock will be affected by country-specific shocks, such as fiscal or monetary policy shocks. The exposure to industry-specific shocks captures the extent to which the return on an individual stock is affected by industry-specific shocks, such as the electronics downturn in 1996–1997 or the recent downturn in IT demand.

13. **The analysis indicates that Singapore's corporate sector is on average more sensitive to external shocks than elsewhere.** Figure III.3 examines the exposure of stocks in Singapore, Singapore's competitors and the overall average stock in the sample to global shocks. It shows that 6.78 percent of the variation in Singapore's stocks is attributable to global shocks, which is above the global average (6.25 percent) and also above Singapore's competitors. Figure III.3 also shows that the exposure to country-specific shocks is exactly the reverse, with 37.88 percent of the variation in Singapore's stock returns explained by domestic shocks, below the 48.24 percent in Singapore's competitors. This evidence is consistent with Singapore's status as a small open economy. On balance, using this decomposition of stock returns, Singaporean firms are seen to be more sensitive to shocks from abroad than stocks in other countries in the region, while they are less sensitive to domestic shocks than elsewhere in the region.

14. **There is also evidence that Singapore's industrial composition plays a role in the transmission of shocks from abroad.** Figure III.3 shows the proportion of variation explained by global shocks for the different industries in the balanced sample. It shows that the IT hardware sector has by far the largest exposure to global shocks. Figure III.3 also shows that this sector ranks near the bottom in terms of its exposure to country-specific shocks. In other words, the fact that the IT hardware sector makes up such an important part of Singapore's industrial structure means that its economy is more exposed to external shocks than some of its neighbors.

D. Conclusion

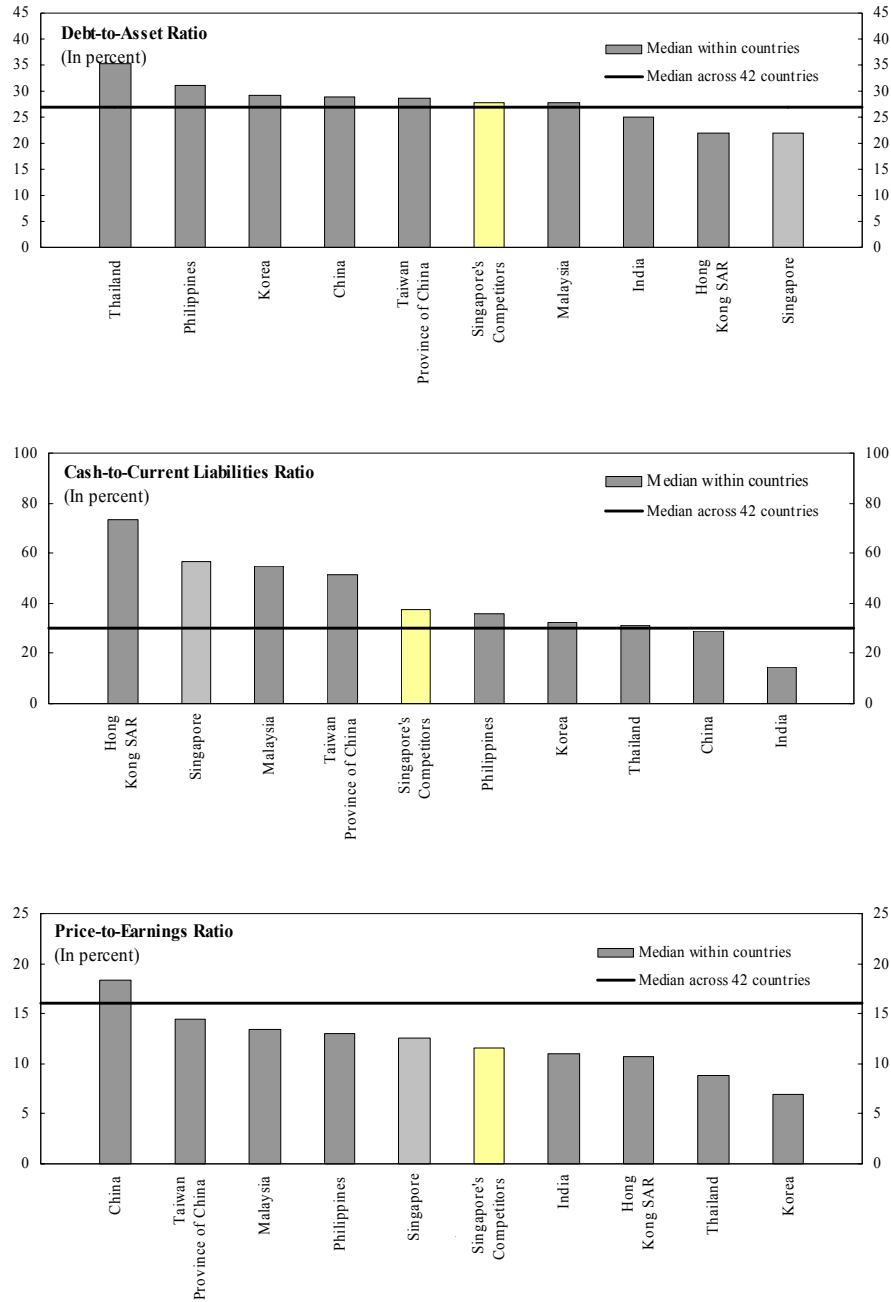
15. **This chapter finds that Singapore's nonfinancial corporate sector is in good health, in spite of the large number of shocks that have buffeted the economy in recent years.** There are, however, signs that profitability has been hit harder during the recent downturn than in neighboring countries given Singapore's high exposure to the IT hardware sector. While some of the decline in profitability may be cyclical, part of it may also be structural, related to the emergence of lower-cost regional producers in this sector.

16. **Consistent with Singapore's status as a small open economy, this chapter finds that Singaporean firms are more sensitive to foreign shocks than elsewhere in the region.** This greater sensitivity takes two forms. Firms across sectors are more open, a function of their greater dependence on foreign markets. In addition, the IT hardware sector, which is still the single most important manufacturing sector in the economy, is highly sensitive to external shocks. As market forces reshape Singapore's economy in the years ahead, reducing the importance of this sector, Singapore's exposure to shocks from abroad may decline. But it is likely to remain higher than elsewhere, given that Singapore corporates have a higher foreign exposure than in other countries.

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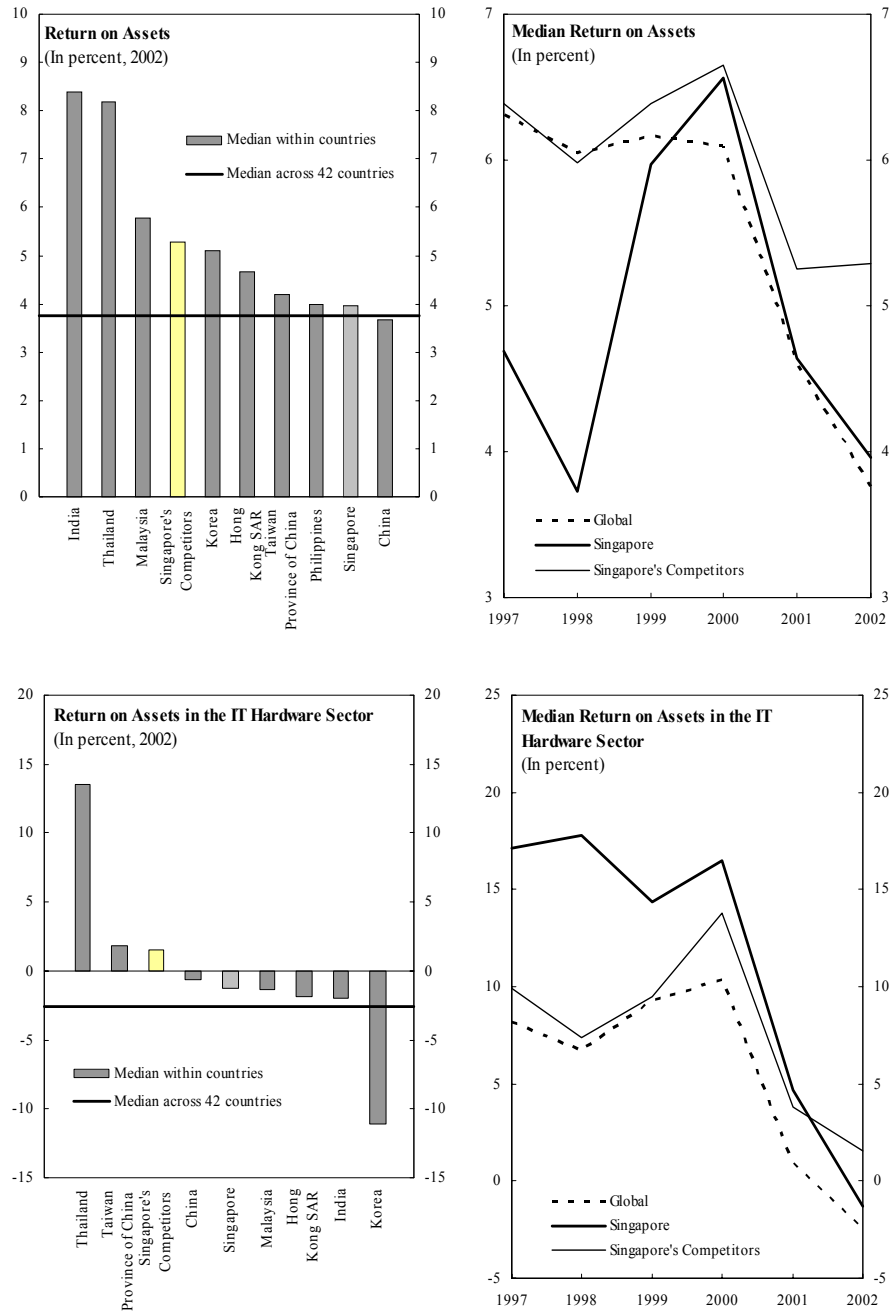
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Figure III.1. Indicators of the Corporate Health in the Nonfinancial Corporate Sector, 2002
 (Singapore's Competitors: Hong Kong, SAR, Korea, Malaysia, Thailand, Taiwan Province of China, and Philippines)



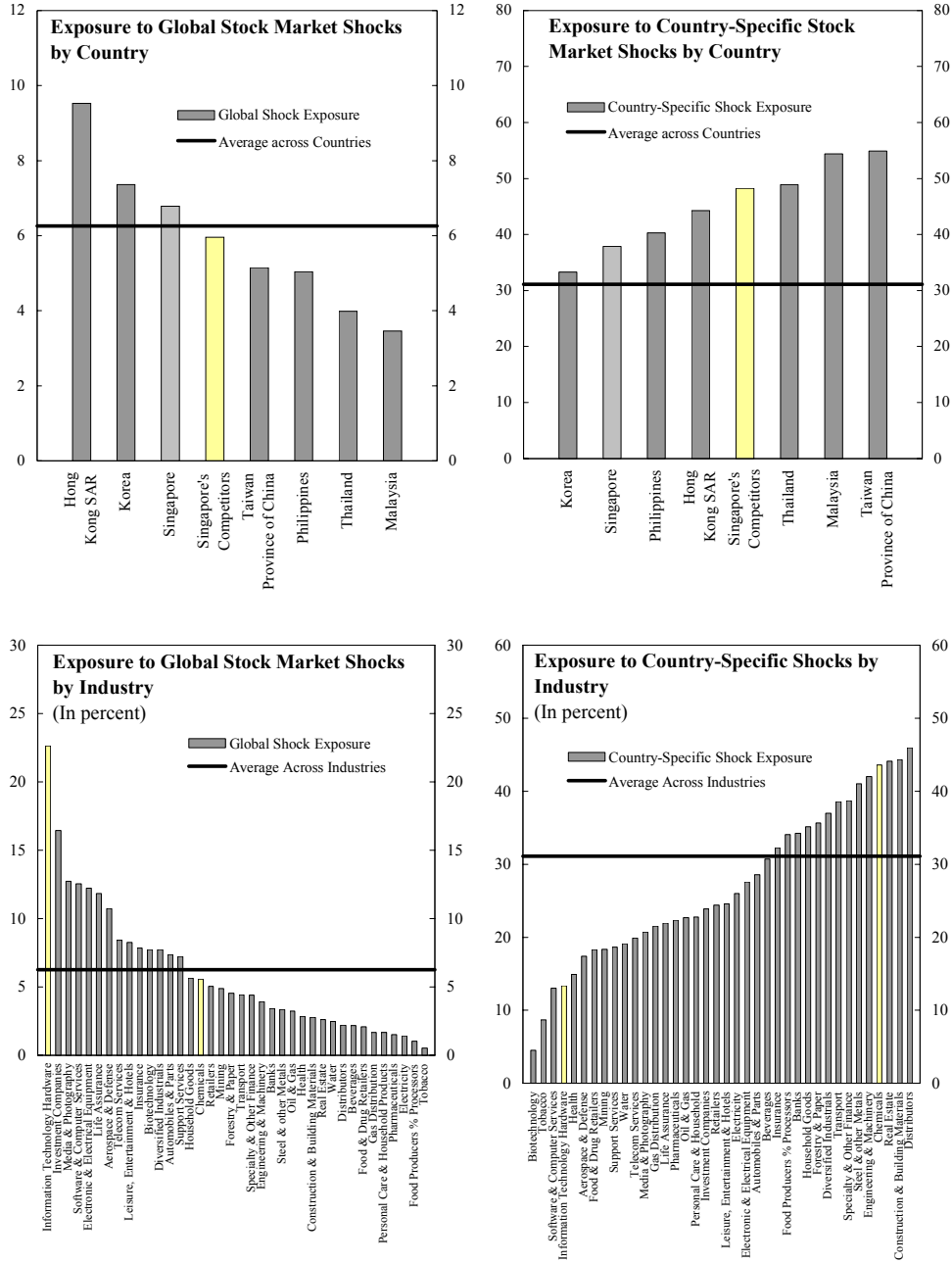
Source: Worldscope.

Figure III.2. Indicators of Corporate Profitability for Nonfinancial Corporate Sector
 (Singapore's Competitors: Hong Kong, SAR, Korea, Malaysia, Thailand, Taiwan Province of China, and Philippines)



Source: Worldscope.

Figure III.3. The Role of the Corporate Sector in the Transmission of Shocks to Singapore, 1990-2002
 (Singapore's Competitors: Hong Kong, SAR, Korea, Malaysia, Thailand, Taiwan Province of China, and Philippines)



Source: Worldscope.

THE DATA AND ESTIMATION

This Annex describes the data used to analyze the health of the corporate sector and explains the model used to assess its role in the transmission of external shocks.

1. The data

The data were constructed by Brooks and Del Negro (2002) and cover 9,679 listed companies in 42 developed and emerging markets. The sample includes all firms in the Datastream Global Market Indices for these markets and is augmented with a list of active and inactive stocks from Worldscope.¹ Each company belongs to one of 40 Datastream Global Market industries, which are described in Table 1 of Brooks and Del Negro (2002). For each firm, the data cover monthly total U.S. dollar-denominated stock returns and market capitalizations from January 1985 to April 2003. For each company, the data also include annual fiscal year-end Worldscope data from 1985 to 2002 on the debt-to-asset ratio, the cash-to-current liabilities ratio, the price-to-earnings ratio, and the return on assets.

The sample must satisfy two criteria: (i) it must provide a good representation of the universe of listed companies within Singapore; and (ii) it must provide a good representation of Singapore within the global stock market. Table III.1 shows that both criteria are met. It gives a snapshot of the sample in December 2000. At that point, the data contain 164 Singapore companies, somewhat below the universe of listed firms of 418, according to the Standard & Poor's Emerging Stock Markets Factbook (2001). But in market capitalization terms, the data come close to approximating the Singapore's stock market. Its market capitalization in the sample measures \$168 billion, the same order of magnitude as the market capitalization in the Stock Markets Factbook. Because the sample captures virtually the entire Singapore market with only 40 percent of companies listed in Singapore, this means that the data cover the largest, systemically important firms in the market. This degree of coverage is sufficient, given that the focus in this chapter is on corporate vulnerability and shock transmission.

¹ See <http://www.datastream.com/product/investor/index.htm> for details on the Datastream Global Market Indices. A key aspect of the dataset is that it includes firms that have become inactive over time, due to bankruptcy or merger for example. This phenomenon is significant, with 1,996 firms in the sample becoming inactive after January 1995.

Table III.1 also shows that Singapore made up 0.51 percent of the global stock market in market capitalization terms in December 2000. Though small, this is close to 0.48 percent according to the Stock Markets Factbook and thus a reasonable representation of Singapore within the global stock market. The United States makes up almost 50 percent of the sample in percent of overall market capitalization, which is reasonable according to the Stock Markets Factbook. The United Kingdom and Japan each make up close to 10 percent of the sample, again consistent with the Factbook. The overall market capitalization of the sample amounts to \$32,965 billion in December 2000, the same order of magnitude as that in the

	The Data			S&P Stock Markets Fact Book		
	Number of firms	Market capitalization (In billions of US\$)	Market capitalization (Weight in percent)	Number of firms	Market capitalization (In billions of US\$)	Market capitalization (Weight in percent)
United States	1,309	16,040	48.66	7,524	15,104	47.42
United Kingdom	986	3,116	9.45	1,904	2,577	8.09
France	363	1,657	5.03	808	1,447	4.54
Germany	404	1,193	3.62	1,022	1,270	3.99
Italy	219	785	2.38	291	768	2.41
Japan	1,189	3,328	10.1	2,561	3,157	9.91
Canada	424	803	2.44	3,977	841	2.64
Australia	207	387	1.17	1,330	373	1.17
Austria	82	33	0.10	97	30	0.09
Belgium	127	143	0.43	174	182	0.57
Denmark	109	116	0.35	225	108	0.34
Hong Kong SAR	208	673	2.04	779	623	1.96
Ireland	79	83	0.25	76	82	0.26
Netherlands	183	703	2.13	234	640	2.01
Norway	103	71	0.22	191	65	0.2
Sweden	145	314	0.95	292	328	1.03
Switzerland	185	845	2.56	252	792	2.49
Korea	168	170	0.52	1,308	172	0.54
Malaysia	168	103	0.31	795	117	0.37
Singapore	164	168	0.51	418	153	0.48
South Africa	189	159	0.48	616	205	0.64
Philippines	71	25	0.07	230	52	0.16
Luxembourg	31	42	0.13	54	34	0.11
New Zealand	69	23	0.07	144	19	0.06
Spain	135	426	1.29	1,019	504	1.58
Finland	106	251	0.76	154	294	0.92
Thailand	78	33	0.10	381	29	0.09
Taiwan Province of China	165	276	0.84	531	248	0.78
Argentina	73	53	0.16	127	166	0.52
Greece	109	90	0.27	329	111	0.35
Mexico	117	117	0.35	179	125	0.39
Portugal	59	76	0.23	109	61	0.19
Turkey	72	247	0.75	315	70	0.22
Chile	92	54	0.16	258	60	0.19
Brazil	189	114	0.34	459	226	0.71
India	153	123	0.37	5,937	148	0.46
Indonesia	77	24	0.07	290	27	0.08
China	152	52	0.16	1,086	581	1.82
Peru	60	4	0.01	230	11	0.03
Poland	60	28	0.09	225	31	0.1
Colombia	31	4	0.01	126	10	0.03
Czech Republic	59	13	0.04	131	11	0.03
Mean	214	785	2.38	885	758	2.38
Median	131	120	0.36	292	159	0.50
Total	8,969	32,965	100	37,188	31,852	100

Factbook. Coverage is relatively stable going back in time. In December 1990, for instance, the overall market capitalization of the sample comes to \$9,102 billion, about 97 percent of stock market capitalization in the 42 sample countries as measured by the Factbook.

2. The model

The factor model can be briefly described as follows. Let R_{nt} denote the excess return on stock n in period t over the riskless rate, where n goes from 1 to N and t goes from 1 to T . It indexes countries with the letter c ($c = 1, \dots, C$) and industries with the letter i ($i = 1, \dots, I$). The model is then described by the following equation:

$$R_{nt} = \mu_i + \beta_n^G f_t^g + \sum_{c=1}^C \beta_{nc}^C f_t^c + \sum_{i=1}^I \beta_{ni}^I f_t^i + \varepsilon_{nt} \quad (1)$$

where f_t^g, f_t^c and f_t^i denote the global factor g , the country-specific factor c and the industry-specific factor i , respectively, and ε_{nt} represents the idiosyncratic shock to the return on stock n , all in period t . The factors are unobservables, as in the latent factor models employed widely in the finance literature. However, in this model the factors are “identified,” which arises from the fact that zero restrictions are imposed on the betas: the model restricts β_{nc}^C and β_{ni}^I to zero if stock n does not belong to country c or industry i . For example, if stock n is a U.S. chemical company, it restricts the loadings of stock n on any country factor other than that for the U.S. and on any industry factor other than the chemical industry factor to be zero.

The model is estimated using the Lehman and Modest (1985) EM algorithm.² To estimate (1) via maximum likelihood, distributional assumptions need to be imposed. The assumptions are that (i) both the factors and the idiosyncratic shocks are normally distributed *i.i.d.* random variables, uncorrelated with each other:

$$f_t^g, f_t^c, f_t^i \xrightarrow{d} N(0,1) \text{ all } g, c, i \quad (2.1)$$

$$\varepsilon_{nt} \xrightarrow{d} N(0, \sigma_n^2) \text{ all } n \quad (2.2)$$

$$E_{t-1} [f_t^k f_t^m] = 0 \text{ for } k \neq m, E_{t-1} [f_t^k \varepsilon_{nt}] = 0 \text{ all } k, n \quad (2.3)$$

² Convergence is reached whenever the mean squared gradient is less than 10^{-4} . Lehman and Modest (1985) adopt a slightly tighter criterion, namely that the sum of the squared gradients is less than 10^{-4} . Given that the EM algorithm is notoriously slow to converge close to the summit of the likelihood and that our results do not change as long as the mean squared gradient is less than 10^{-2} , we adopt a slightly looser convergence criterion.

for all t , where the assumption of a unit variance is purely a normalization assumption, and (ii) the idiosyncratic shocks are cross-sectionally uncorrelated:

$$E_{t-1}[\varepsilon_{nt}\varepsilon_{mt}] = 0 \quad (3)$$

for all t , n , and m . In the remainder of this chapter, the results are based on variance decompositions of returns for individual stocks. These are obtained as follows. From equation (1) it follows that the variance of excess returns for stock n can be decomposed as the sum of the variances attributed to global, country, and industry shocks and the idiosyncratic component:

$$Var(R_{nt}) = (\beta_n^G)^2 + (\beta_{nc}^C)^2 + (\beta_{ni}^I)^2 + \sigma_n^2 \quad (4)$$

where c and i denote the country and the industry to which that stock n belongs. This variance decomposition measures the importance of global, country- and industry-specific shocks for each individual stock in the sample. For illustration, companies that are more sensitive to foreign shocks will have a high proportion of their stock returns explained by global shocks, while firms that have a low exposure to foreign shocks will have a low proportion.

The model is estimated for monthly U.S. dollar-denominated returns in excess of the U.S. Treasury bill rate. It is estimated for a balanced subset of the data, which covers 3,843 stocks from January 1990 to April 2003 in 28 countries: Australia (82), Austria (28), Belgium (60), Canada (183), Denmark (58), Finland (29), France (172), Germany (199), Greece (33), Hong Kong SAR (98), Ireland (40), Italy (107), Japan (806), Korea (65), Malaysia (103), the Netherlands (94), New Zealand (28), Norway (30), the Philippines (18), Portugal (22), Singapore (75), Spain (77), Sweden (52), Switzerland (100), Thailand (31), Taiwan Province of China (44), the United Kingdom (510) and the United States (699).

IV. DEVELOPMENT OF THE CORPORATE BOND MARKET¹

A. Introduction

1. **This chapter examines the scope for Singapore to develop a more active corporate bond market.** Development of the corporate bond market is one way to ensure the maintenance and expansion of Singapore's role as a regional financial center. At present, further development of the market is constrained by Singapore's small economic size at a time when large-scale mature financial markets provide increasing direct competition. A main conclusion is that development of the corporate bond market may require tapping into regional financial flows where the expertise of local asset managers can provide a measure of value added in valuing and investing in these securities.
2. **The authorities have taken measures to encourage financial sector development.** The objective is to expand employment in the financial sector at a time when lower value-added jobs in manufacturing are being lost to low-cost regional economies. These efforts are an application of the Economic Review Committee's recommendations on ways to remake Singapore into a diversified, entrepreneurial, trading hub.
3. **The potential for the bond market to provide financing for local small- and medium-sized companies in Singapore and the region has yet to be realized.** Local banks have finished a cycle of debt write-off in Singapore, and may be reluctant to engage in unsecured term lending.² At the same time, large financial institutions in Singapore that invest in securities prefer only the safest available names, those which they feel comfortable holding to maturity, in this highly illiquid market. They favor, for this reason, government securities and the bonds of government-linked companies.
4. **A conclusion of this chapter is that there may be scope for policy measures to support regional underwriting of corporate debt in Singapore.** This would both increase local underwriting activity and take advantage of local asset management expertise in evaluating regional business risks.

B. Characteristics of Singapore's Financial Markets

5. **Singapore is a major international financial center with traditional activity concentrated in banking.** In international bank lending, Singaporean banks represented about 3 percent of total international bank assets at end-2002, compared with Hong Kong SAR (2.9 percent) and London (18.7 percent). The financial sector accounted for about

¹ Prepared by Lars Pedersen (ext. 36774).

² Classified loans (current loans that exhibit definable weaknesses in addition to nonperforming loans) fell from 8.5 percent of total loans in 1999 to 5.3 percent in September 2003 as banks absorbed these losses.

11 percent of GDP and 5 percent of total employment in 2002. The centerpiece of Singapore's financial center has been the Asian Dollar Market (ADM), total assets of which were \$486 billion at the end of 2002. But growth has been weak in the past few years because of the regional economic environment, and the reduced foreign operations of Japanese banks. Given the small size of the domestic economy, the bulk of commercial banking operations are conducted in the ADM and largely carried out by foreign banks with a limited domestic retail market presence.³

6. **Traditional treasury and swap operations, linked to international banking, are well developed in Singapore.** Foreign exchange trading and swap activity are highly developed and markets are deep, in part because the local financial system is largely derivative of the mature financial markets. Since monetary policy is implemented through intervention in the foreign exchange market based on a target band for trade-weighted exchange rate index, local interest rates are derived from those abroad through the swap market. A deep swap market allows investors and issuers to easily convert payment streams into alternative duration and currency compositions at low cost.

7. **In the area of bond market development, policies have focused on developing the infrastructure for a viable corporate bond market.** A liquid government debt market has been created, notwithstanding that the fiscal position has generally been in surplus, providing a key component for efficient setting of the price of corporate bonds, by establishing the risk-free rate at each duration. Having a liquid government debt market, and repurchase arrangements, permits hedging by bond market intermediaries and hence increases liquidity in corporate bonds.

C. Conditions for Bond Market Development

Sufficient Scale

8. **Singapore faces particular difficulties in achieving sufficient scale to successfully establish a corporate bond market.** Direct distribution of securities to investors through specialist underwriters works best when continuous large-scale financial flows reduce overhead costs. Accordingly, more efficient distribution will always be available for recognized credits in the mature market centers, limiting the scope for corporate bond markets in any secondary center, unless some specific regional advantage for locally issued bonds emerges. These disadvantages of scale may be less important in the asset management business, where the key structural role of underwriting desks is not a factor (see Section F).

³ See Financial System Stability Assessment (FSSA) for a more detailed description.

9. **The development of a corporate bond market may be beneficial for economic performance.**⁴ When claims are broadly distributed, concentrated risk on the balance sheet of systemically important bank intermediaries is reduced. At the same time, the broad distribution of claims could facilitate market valuations that incorporate impartial judgments about debtors and early recognition of emerging credit difficulties. The broader range of corporate liabilities now available in mature markets, including bonds and securitized debt, and investors specialized in those assets, may have increased the likelihood that some financing means are always available, reducing systemic risks.

10. **The advantages of fixed income finance are, however, only likely to be attained at substantial scale.** Each individual borrower who relies on issuing fixed income instruments at infrequent intervals must manage his other cash needs in a more elaborate and detailed fashion than otherwise.⁵ At the same time, investors in fixed income markets, where a small possibility of a large loss is always present, typically require large and highly diversified portfolios to achieve stable statistical properties for their investments. Large professionally managed portfolios are for this reason typical in mature corporate bond markets. Lastly, liquidity and continuous pricing are often related to the frequency of new issues over a minimum size, which in turn depends on the size of aggregate borrowing in the market.

11. **Empirical observation confirms the key role of scale in the development of bond markets.** In cross-country comparisons, deeper fixed income markets (measured as higher capitalization to GDP ratios) tend to emerge in larger economies. Bond markets do, indeed, become more efficient and hence more attractive with increased scale. In a related finding, systems with stronger banking functions tend to have smaller bond markets.⁶ The presence of effective financial alternatives can apparently inhibit development of the scale required for effective bond market development.

Other Factors

12. **Obstacles to a viable corporate bond market in Singapore include both general considerations of size as well as the specific features of local institutions.** One adverse effect of small scale is the limited use of third-party credit ratings in Singapore. Credit ratings reduce costs for investors by facilitating a quick comparison of risk and pricing between companies. Third party risk assessments, however, depend upon stable audited statements,

⁴ See International Capital Markets (2003) for a general statement, Alan Greenspan's (2004) speech for an application in the ability of mature markets to absorb a large loss in value, and Hakansson (1999) for an argument that corporate bonds increase the responsiveness, flexibility and safety of a financial system.

⁵ See Endo (2001).

⁶ See Schinasi (1998).

not generally available for smaller companies in Singapore or the region. They also depend on the willingness of borrowers to pay fees for a credit rating.

13. **The strength of Singapore's banking system may also limit the attractiveness of bond markets to issuers.** Banks in Singapore are well regulated and hold ample capital and liquidity.⁷ Currently their main business problem is finding an outlet for deposit funding at a time of limited loan growth. Companies in Singapore with high creditworthiness find bank lending easily available at low cost with the observed result that growth in Singapore dollar bond activity has been relatively constrained. The recent mergers among Singaporean banks, however, could mean that once an expansion begins, the limit on individual bank lending at 25 percent of bank capital will begin to bind, encouraging borrowers to seek financing alternatives including bond issuance.

14. **Remaining restrictions on the international use of Singapore dollars by foreign residents may be an indirect impediment to investors.** Foreign debt issuers must convert their proceeds through the swap market when they transfer the funds abroad and financial institutions are to exercise vigilance to avoid lending to foreign financial institutions for speculative purposes. While not binding for most purposes, these restrictions might arguably dissuade some foreign issuers from using a market subject to constraints, although it has not stopped many foreign institutions from tapping the capital markets.

15. **Weak growth in Singapore in recent years has reduced credit demand and inhibited the introduction of new financial instruments.** This was not felt immediately in corporate bond issuance because a wave of mature market borrowers sought to sell bonds in every market available, including Singapore, to extend their financing and avoid rollover risk. A surge in bonds issued to finance local bank mergers up to 2001 was another reason for a temporary surge in activity, followed by a relative pause as underlying credit demand was restrained (Table IV.1). Issuance activity has since turned up with the economic recovery.

D. Regional Credit

16. **Regional credit demand, which could be an outlet for Singapore savings, has been limited by lingering adjustment to the Asian financial crisis.** Borrowers in the region have continued to adjust to the financial risks they perceive by reducing leverage levels—that is selling equity and accumulating cash balances. The regional pattern is reflected in both high levels of national foreign exchange reserves and in the issuance by local companies of equity, the sale of outstanding equity to foreign investors, and an inflow of foreign capital into local banking systems.⁸ This regional pattern has left Singapore's financial system to accumulate low-margin wholesale bank deposits in the mature markets.

⁷ See Table 2 of FSSA.

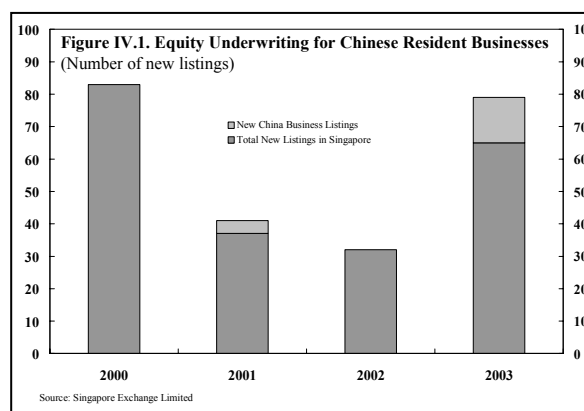
⁸ See Elson (2002).

17. **The absence of regional bond markets is a prominent gap in the range of financial instruments available.** The cost of equity finance for local companies could be reduced with long-term bond finance, and the returns of a properly managed portfolio of regional bonds should exceed those available in the G-3 government bill and money markets, where national reserves are now widely invested. Eventually, under official encouragement or otherwise, the advantages of fixed income investment in the region should attract participation.

Table IV.1. Corporate Bonds Issued and Outstanding in Singapore							
	1997	1998	1999	2000	2001	2002	2003
	(In billions of U.S. dollars).						
Total corporate bonds outstanding	18.5	19.4	25.7	28.6	43.7	52.5	59.8
Issued in Singapore dollars	10.7	12.1	16.2	19.7	25.8	28.5	29.9
Issued in other currencies	7.7	7.3	9.6	9.0	17.9	24.0	29.9
Lehman Credit Index eligible	0.8	2.2	6.8	7.3	9.7
Total new issues							
Issued in Singapore dollars	4	2.4	5.5	8.3	11.9	10.5	11.1
Issued in other currencies	1	3.2	6.2	20.9	27	11.1	22.7
	(In percent)						
Singapore: Total outstanding to GDP 1/	22.0	23.0	31.0	31.0	53.0	57.0	64.0
Index eligible outstanding to GDP 2/	0.3	0.8	2.4	2.7	3.6
U.S.: Index debt outstanding to GDP 3/	70.0	73.0	69.0	70.0	77.0	84.0	86.0

Sources: Monetary Authority of Singapore; Singapore Department of Statistics, Bureau of Economic Analysis, Lehman Brothers.
 1/ Singapore definitions included 60 percent of non-Singapore dollars and 35 percent of Singapore dollars new issues in 2002-01 under \$50 million.
 2/ Lehman Singapore Credit Index, over US\$300 million equivalent, over one-year maturity, issued in Singapore dollars.
 3/ Lehman Universal Aggregate, over one-year maturity and, including high yield, CMBS, matured Eurodollar issues, and emerging market debt.

18. **As regional borrowers retrench, and in the absence of developed regional bond markets, Singapore's outward capital flows—the counterpart of its current account surpluses—continue to be invested largely in mature markets.** Nevertheless, alternative investment outlets are emerging. Government-linked companies have been seeking direct investment opportunities in the region, local banks have expanded into Malaysia, Indonesia and Hong Kong SAR in search of lending opportunities, and local equity markets have absorbed an increase in regional issues, particularly from China (Figure IV.1). With respect to the latter development, manufacturing companies in China have found investors in Singapore willing to offer a high



market value for their business prospects, possibly reflecting local experience in assessing manufacturing stocks.

E. Activity in Singapore's Corporate Bond Market

19. **Under the structural and cyclical handicaps noted above, Singapore's corporate bond market remains largely a market in waiting.** Underwriting activity is low and bonds, once issued, tend to be held to maturity. Large-sized, long duration, issuance is less than the overall aggregates show. As a result, the liquidity, price discovery, and potential for portfolio shifts that would be available to investors in a fully developed bond market are not fully available.⁹ Still, a level of issuance by foreign and Singaporean borrowers has taken place, although to a limited extent, which suggests that there is a potential for a more viable market when institutional and cyclical factors improve.

20. **New bond issuance activity, particularly in U.S. dollars, has picked up after a pause.** Issuing activity by foreign borrowers in foreign currency was restrained in 2002 by the last stages of distress in global credit markets. In 2003, however, issuance was nearly double the level of the year before, despite continued financial market uncertainties. Very large, liquid, issues as included in the Lehman bond index, however, remain relatively limited.

21. **Low-risk issuers have dominated the bond market.** Government-linked and commercial property companies have the credit recognition necessary for immediate acceptance by investors. Property companies borrowed 16 percent of the new issue amounts raised in Singapore dollars in 2002. International financial companies are also traditional bond issuers in Singapore; out of foreign issuers in Singapore dollars, 46 percent of issuance was for financial institutions. These borrowers typically issue in small size and short maturities to capture small opportunistic differences in funding costs—and these issues are commonly excluded from standard bond market indices elsewhere.¹⁰

22. **A large and increasing share of underwriting has been linked to securitized debt.** In 2002, 47 percent of all Singapore dollar bonds issued were the liabilities of special purpose vehicles, while fully 56 percent were structured (including asset backed securities, equity linked notes and other structured products). Among foreign currency bonds, 46 percent were structured obligations. High quality structured liabilities of well recognized financial entities are clearly acceptable to Singapore and other regional investors.

23. **International underwriting activity for Singapore-based underwriters has recovered in 2003 and into early 2004** (Table IV.2). Regional issuers increased their

⁹ See Chapter V, Section B of FSSA for a more detailed description.

¹⁰ See Monetary Authority of Singapore (MAS) (2003b).

borrowing, to a pace not seen since 2001.¹¹ At the same time, credit differentiation, which is required for pricing and distribution of riskier issuers, rated BBB+ or lower, for example, is increasing. Earlier, issuance with Singapore underwriting participation was characterized by very high ratings or no ratings, and a high share of bank and financial company names, all of which are typical of an undifferentiating credit culture. Lastly, activity in financing vehicles, including special purpose vehicles, has increased compared with earlier years as the techniques for combining claims into new securitized claims are extended.

Table IV.2. International Bond Issuance Linked to Underwriters in Singapore and Hong Kong SAR

	1995	1996	1997	1998	1999	2000	2001	2002	2003
Singapore									
Total (in US\$ millions)	13,603	13,878	22,448	17,768	20,940	10,971	37,384	7,146	14,448
Rated BBB+ or lower	330	1,505	900	...	350	432	9,597	719	4,350
Regional issuers	2,632	3,263	4,266	200	808	1,292	838	958	4,186
Financing vehicles	295	1,756	1,290	408	2,435	1,490	2,008	2,228	1,945
Percentage shares									
Local issuers	2	8	3	6	19	41	34	45	44
Bank and finance issuers	39	49	78	64	54	30	71	26	28
In U.S. dollars	77	73	80	81	70	39	67	25	63
Hong Kong SAR									
Total (in US\$ millions)	24,549	26,603	33,468	15,202	7,242	2,768	4,056	3,627	9,798
Rates BBB+ or lower	1,271	5,417	3,575	1,300	1,300	81	2,228	880	3,880
Regional issuers	4,763	11,210	8,951	2,180	1,645	968	2,762	1,314	3,919
Financing vehicles	1,969	4,041	7,073	507	2,225	852	214	679	4,758
Percentage shares									
Local issuers	1	4	3	1	2	6	4	4	2
Bank and finance issuers	63	58	62	60	34	49	19	55	17
In U.S. dollars	54	75	79	70	67	43	68	50	74

Source: Dealogic-International bonds underwritten or listed in Hong Kong SAR.

F. Singapore's Asset Management Industry

24. **An expanding asset management industry should provide a deeper pool of local buyers for new corporate bond issues and improve the attractiveness of local corporate bond underwriting.** Recent initiatives to allocate funds to the local asset management industry have facilitated growth of the sector. Choices available to local investors in the deployment of their savings in the Central Provident Fund (CPF) have been increased. As well, \$6 billion of CPF assets were placed directly with local asset managers.¹² In response to

¹¹ Singapore-linked international bond issues are those in which Singapore-registered underwriters participated or that are registered in Singapore. The international bonds involved are sold in foreign currency or otherwise designed for offshore investors.

¹² Over three years starting in 1999.

these measures, several asset management firms set up and others expanded to offer alternative investments to Singaporean savers.

25. **The Economic Review Committee has recommended measures to reduce cost of capital market services used by asset managers.** Hedge funds may find costs reduced by the encouraged establishment of specialist international law firms, prime brokers, and administrators. Global trust operations may be made easier after trust and company legislation is reformed. Lastly, processing centers should find support in a cluster of Universal Processing Centers and supporting technology companies. The policy approach is one of lowering costs where possible through investment in infrastructure or legal changes for the benefit of the businesses involved.¹³

26. **Recent increases in institutional funds under management in Singapore have been due to the transfer there of regional portfolios previously managed abroad.** Nondiscretionary, mostly fixed-income fund rose by 36 percent in 2002 to \$93 billion. The increase consisted of: new global mandates for investors, transfers of existing portfolios to Singapore for management there, and expansion of the management and advisory function on the pan-Asian portion of global mandates. Discretionary funds, which are mostly equity, were up 9 percent at \$106 billion. Still, investment specialists working in Singapore remain predominantly equity experts as the relatively small amounts under management may have encouraged specialization in higher-return investment decisions.

27. **Mutual funds available to individual local investors in the CPF have increased rapidly, but remain a small source of asset management funds.** Collective investments available to CPF investors rose 47 percent to \$6 billion in 2002, while other collective schemes were up 33 percent to \$6 billion. The most popular retail products by far have been capital-protected funds that effectively promise an equity-related gain with limited loss, reflecting an aversion to equity risk after recent equity market volatility, but also an appetite for higher returns than are available in bank deposits.

28. **While minimum effective scale is clearly far smaller in the asset management business than it is in the corporate bond business, larger scale will become increasingly important.** Singapore asset managers may be subject over time to the same forces that are driving global money management toward larger size in order to spread the cost of proprietary research to replace traditional broker-provided research. An alternative to larger size is to adopt a low-overhead route with indexed products, which replicate average market behavior at relatively low portfolio size. Singapore's effort to foster a local asset management business has resulted in a large number of start-up managers that are small and may be subject to a round of consolidation, although the amounts under management should continue to climb.

¹³ See MAS (2003c).

G. Conclusion

29. **This paper has discussed recent developments in Singapore's corporate bond market and factors that have limited its growth.** Economies of scale play a great role in reducing corporate bond issuance costs, and the absence of scale may pose an obstacle to development of a deep and liquid market in the aftermath of a recession that has depressed financial activity. But in this situation Singapore has two advantages: a growing asset management business and its presence in a region that is under-served by corporate bonds.

	1998	1999	2000	2001	2002
Nondiscretionary assets	23.5	54.3	63.5	68.3	92.7
Discretionary assets	67.8	109.6	96.2	97.7	106.0
<i>Of which:</i> Percent shares					
Equity	64	69	59	54	49
Bonds	16	15	19	21	30
Collective investment schemes	...	2	6	8	7
Cash, deposits, money markets	20	12	14	15	11
Other	...	2	2	2	3
<i>Of which:</i> Funded in Singapore 1/	21	25	25	29	30
Of discretionary bond assets: share in Singapore and Asia Pacific			49	54	56
Number of unit trusts	127	187	265	319	382
Total assets	91.3	163.9	159.7	165.9	198.7
Source: Monetary Authority of Singapore "2002 Survey of the Singapore Asset Management Industry."					
1/ Share of total assets in 1998; share of discretionary assets in other years.					

30. **Asset managers may be in a position to evaluate new forms of regional asset-backed credit, adding to the value of local bond issuance.** Small and medium companies in the region may not now be well served, particularly in their trade receivable financing, but also in their long-term investment financing needs not met by banks.¹⁴ Derivative products may allow transformation of these claims into U.S. dollar fixed income claims. Structured investment vehicles that accumulate claims on small companies into statistically stable portfolios may allow rating agencies to develop reliable classifications of the obligations.

31. **Policymakers could consider various initiatives to facilitate regional private sector credit securitization.** One such initiative would be to establish an institution to

¹⁴ See Kim (2001).

absorb a partial credit loss, over a set level, on securities issued by smaller regional borrowers. Such an institution, which should charge fees sufficient to fully cover expected costs, could reduce the high initial commercial uncertainty faced by underwriters and investors that seek to assemble a combination of credits into securitized credit bonds. The setting of the loss level and fee structure would need to be considered carefully in order to avoid the potential for moral hazard.

32. **In case a shortage of demand for local securities proves to be the greater obstacle, policies to encourage investment by publicly managed funds may be considered.** For example, aligning guaranteed rates of return at the CPF with market rates—the CPF now guarantees an interest rate of 2.5 percent for the Ordinary Account and 4.0 percent for the Special Account—could encourage members to invest in corporate securities, directly or in unit trusts.¹⁵ Another, related, demand-increasing measure could be to allow the CPF to replace some nonmarketable government securities with high-quality long-term corporate bonds.

¹⁵ See Chapter V, Section B of FSSA.

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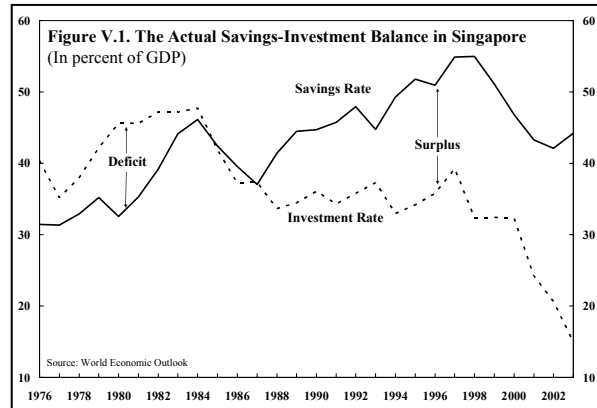
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V. POPULATION AGEING AND THE CURRENT ACCOUNT SURPLUS¹

A. Introduction

1. **Singapore's current account position has shifted from deficits up through the mid-1980s to surpluses thereafter.** In

recent years, these surpluses have grown substantially to around 30 percent of GDP in 2003 (Figure V.1). While much of the recent rise may reflect cyclical factors stemming from weak domestic demand—including a sharp fall-off in investment—longer run structural factors may also be at work. Indeed, even before Singapore was hit by the succession of shocks in recent years, there was a steady rise in the gross national savings rate and a decline in investment.



2. **This chapter assesses the role of demographics in explaining the evolution of the current account balance in Singapore.** It should be noted at the outset that demographics is only one of many factors that can explain the evolution of the current account surplus. The results presented in this chapter are thus not intended to fully explain the evolution of Singapore's current account. Instead, the goal is to isolate the role of demographics in order to shed light on the population-related structural component of the surplus. The chapter uses an optimizing model, in which changes in Singapore's age distribution drive the savings-investment balance, to ask two questions: (i) can changes in the population structure explain the evolution of the savings-investment balance in Singapore? and (ii) is the present level of the current account consistent with an optimizing framework?

3. **The results suggest that population dynamics do help explain the historical shift in Singapore's current account from deficits to surpluses.** They also help to put Singapore's large and rising current account surplus in perspective. They reveal that an important driver underlying these surpluses may in fact be structural, associated with population ageing leading to a decline in investment and a rise in savings.

4. **From a purely optimizing perspective, the model suggests that Singapore's average current account over the past 20 years should have been near balance.** Instead, Singapore's actual current account over this period has been in surplus to the tune of 12 percent of GDP. The fact that this "cyclically-adjusted" surplus is so much larger than that generated by the optimizing model may be due to a number of factors, including the stylized

¹ Prepared by Robin Brooks (ext. 36236).

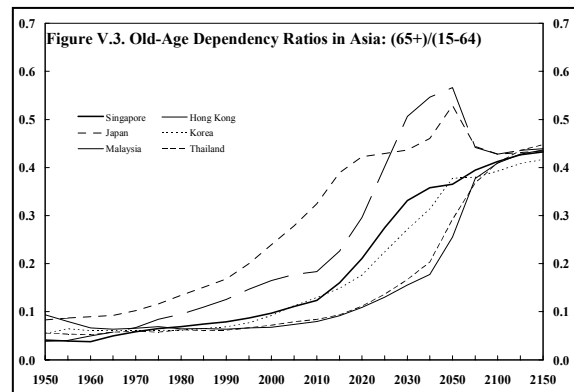
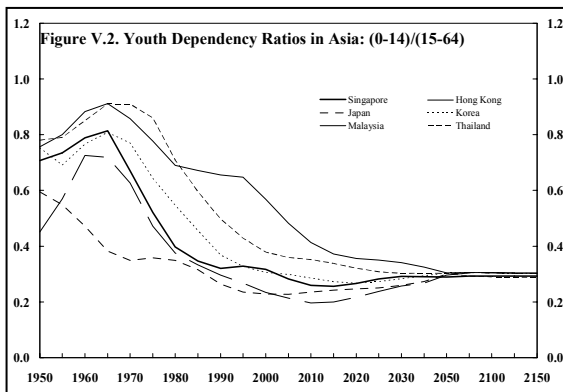
nature of the model, which may omit other factors that could account for a larger structural surplus.²

5. **This chapter is organized as follows:** Section B reports the simulation results and Section C concludes; the Annex provides technical details of the model.

B. Simulating Singapore's Current Account

6. **This section uses an overlapping generations model to simulate the effects of population ageing on Singapore's current account.**³ Underlying the model, which is described in the Annex, are two key assumptions. First, capital is perfectly mobile, so that capital flows equate Singapore's interest rate to the world interest rate at any point in time. Second, as Singapore is a small open economy, the world interest rate is taken to be exogenous. In such a setting, the basic intuition behind the effects of population dynamics on the current account is the following. During periods when the population is ageing rapidly, for example, there will be a surge in the savings rate as workers prepare for retirement, while the investment rate falls, a reflection of the declining workforce. Under the assumption of perfect capital mobility, this mismatch generates capital outflows to the rest of the world, such that the return on capital in Singapore and the rest of the world are equalized. See the Annex for a brief overview of the model and its calibration.

7. **Singapore's population growth has been slowing, while ageing is accelerating.** Figure V.2 shows youth dependency ratios for Singapore and several other Asian countries, calculated as the share of the population aged zero to 14 to the population aged 15 to 64, from 1950 to the present, and projected through 2150. Figure V.3 plots old-age dependency ratios for the same set of countries, calculated as the ratio of those aged 65 and older to the number of individuals aged 15 to 64, again from 1950 through 2150. The old age dependency



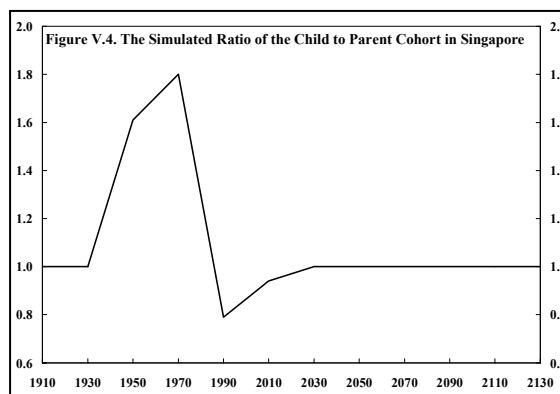
² For related work on generational accounting in Singapore, see Cardarelli (2000a). For a detailed discussion of issues relating to the Central Provident Fund (CPF), see Cardarelli (2000b).

³ See Brooks (2003) for a detailed description of the model.

burden in Singapore is expected to accelerate after 2010, when large numbers of the population will move into retirement. Old age dependency is expected to rise from 12 percent in 2010 to 33 percent in 2030. While this rise may seem dramatic, it is well within the range of other countries in the region. It is more modest than projected increases in Hong Kong SAR or Japan, but more severe than in Korea, Malaysia, and Thailand.

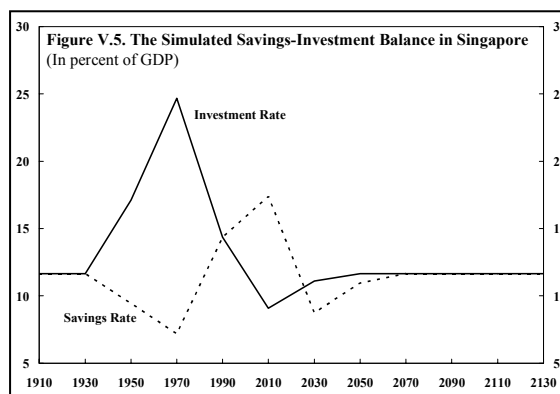
8. Singapore's population boomed in the 1950s and 1960s and contracted thereafter. This section now translates the actual population data into the stylized environment of the model. Figure V.4

shows what this looks like. It plots the ratio of the child to parent cohort that corresponds to the actual population data. The simulated population shift begins in the 1950 period when the child cohort is larger than its parent cohort. This baby boom continues in the 1970 period. The situation is reversed in the 1990 and 2010 periods, when negative cohort growth means that the child cohort is smaller than its parent cohort. The simulated population shift ends in 2030. Cohort growth before and after the simulation is assumed to be zero. The simulated shift thus does not capture the trend decline in fertility in Singapore, but focuses on the transitional dynamics of the population boom and bust.



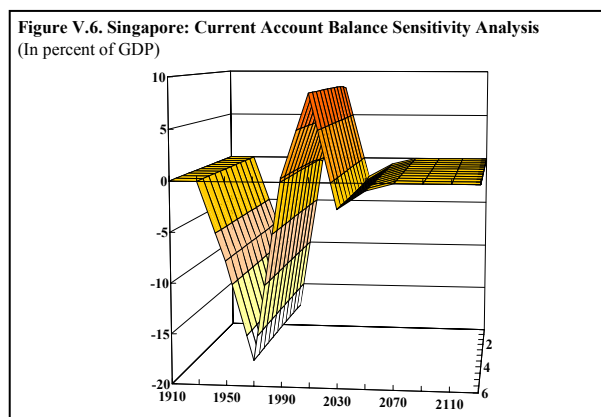
9. The simulation shows that population changes help to explain the evolution of Singapore's current account. Figure V.5 shows the simulated savings-investment balance in the model. As population growth initially accelerates, the investment rate rises in anticipation of a growing labor force.

Thereafter, investment falls as population growth turns negative and the future labor force contracts. In contrast, the savings rate falls during the initial period of rapid population growth, because rising youth dependency makes it harder for households to save. But as the workforce increases and a rising number of households begins to save for retirement, the savings rate rises and peaks in 2010. It falls thereafter, as the last of the large generations—born in the 1970 period—dissaves in retirement in 2030. Thereafter, the savings rate returns to equilibrium.



10. The key driver behind the shift of the current account from deficits to surpluses in the simulation is a big fall in investment. This suggests that the recent decline in investment rates may have, at least in part, a structural component. The simulated profile for the current account is robust to different parameterizations. Figure V.6 explores the

sensitivity of the simulation results with respect to the risk aversion parameter, a key parameter because it affects savings behavior. It depicts the current account in percent of GDP 12 times, increasing the risk aversion parameter from 0.5 to 6 in increments of 0.5. For the 2010 period, the model projects a current account surplus of 8.1 percent of GDP for a risk aversion parameter of 0.5, while it projects a balance of 8.5 percent when the risk aversion parameter is 6. The simulation results are thus not very sensitive to risk aversion.



14. **The model suggests that Singapore’s average current account over the past 20 years should have been near balance.** But over this period, Singapore’s actual current account has been in surplus to the tune of 12 percent of GDP. The fact that this “cyclically-adjusted” surplus is so much larger than that generated by the optimizing model raises two possibilities. On the one hand, the stylized nature of the model means that it omits other factors, such as the CPF savings scheme and other policies to encourage savings in light of national security or political concerns that could account for a larger structural surplus. On the other hand, taken at face value, and abstracting entirely from other factors that could influence the current account, the model suggests that the surplus may be too large from a welfare maximizing perspective. However, caution needs to be taken in drawing such a conclusion, due to the extremely stylized nature of the model.

C. Conclusion

15. **The results of the model simulations presented above suggest that population dynamics do indeed help to explain the shift in Singapore’s current account from deficit to surplus.** An optimizing model successfully replicates the historical shift in Singapore’s current account from deficit to surplus in the early-1980s. In the context of the model, this shift is largely due to a decline in the investment rate, which falls as slower population growth reduces the need for capital formation. Going forward, the model suggests that demographic forces may tend to keep Singapore’s current account in surplus, as increasingly large parts of the population save for retirement.

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MODEL DESCRIPTION

This Annex gives a short description of the model used to simulate the effects of population dynamics on Singapore's current account. The representative agent lives for four periods: childhood, young working-age, old working-age, and retirement. In childhood, agents are not active decision makers and rely on their parents, young workers, for consumption c_t^0 . Young workers have an endowment of one unit of time, which they supply inelastically as labor. They make a standard consumption-saving decision, setting period t household consumption $c_t^1 + (1+n_t)c_t^0$ and saving s_t^1 , where n_t denotes exogenous period t cohort growth, which is given by $N_t = (1+n_t)N_{t-1}$, while the age distribution in period t consists of N_{t-1} young workers, N_{t-2} old workers, and N_{t-3} retirees. The budget constraint facing young workers is therefore:

$$(1+n_t)c_t^0 + c_t^1 + s_t^1 = w_t \quad (1)$$

In old working-age, agents again supply labor inelastically, though they now supply one full unit of labor, their children having become self-sufficient as young workers. Wage income is supplemented by interest on wealth accumulated from the previous period. The constraint of a period $t+1$ old worker is thus:

$$c_{t+1}^2 + s_{t+1}^2 = w_{t+1} + (1+r_{t+1})s_t^1 \quad (2)$$

Here r_{t+1} denotes the return on capital held from period t into $t+1$. Retirees no longer supply labor and, there being no bequests, simply consume down their retirement saving. Since this amounts to a decision rule for consumption, retirees—like children—are not active decision makers in the model. The budget constraint for a period $t+2$ retiree is simply:

$$c_{t+2}^3 = (1+r_{t+2})s_{t+1}^2 \quad (3)$$

Preferences are described by an additively separable utility function. The discounted lifetime utility of an agent born in period $t-1$ is:

$$V_t = \alpha(1+n_t)^{1-\varepsilon} \frac{(c_t^0)^{1-\theta}}{1-\theta} + \frac{(c_t^1)^{1-\theta}}{1-\theta} + \beta \frac{(c_{t+1}^2)^{1-\theta}}{1-\theta} + \beta^2 \frac{(c_{t+2}^3)^{1-\theta}}{1-\theta} \quad (4)$$

This expression shows that young workers, the parent generation, derive utility from feeding their children. As a result, changes in the age distribution generate youth dependency effects on aggregate saving, in addition to old-age dependency effects. This feature of the model has the advantage that it permits a more accurate depiction of saving behavior over the life cycle. It also allows for the possibility that lower youth dependency from declining fertility, a key side-effect of population ageing, may offset the adverse effects on aggregate saving from old people dissaving in retirement. The magnitude of the youth dependency effect is determined

by α , which controls the extent to which parents care for their children. The former parameter determines if parents discount the utility of their children, which is true for $\alpha < 1$. Turning to other parameters in the model, the subjective discount factor is given by β , where $0 < \beta < 1$, while θ is the coefficient of relative risk aversion.

Output is generated by a standard Cobb-Douglas production function. The world rate of return on capital is fixed exogenously at 4 percent per year. The assumption of perfect capital mobility means that capital inflows and outflows keep Singapore's capital-labor ratio such that the return on capital in every period is also always fixed at 4 percent annualized. The share of capital in output is set to one-third, while depreciation occurs at a rate of 5 percent per year. The subjective discount factor is set at 0.44, which amounts to an annualized rate of 0.96, which is standard in the literature. In the baseline simulation, the coefficient of relative risk aversion is set to one, which is the special case of log utility.